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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,081	09/28/2001	Hong Hie Lee	DE-1302	6636

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EXAMINER

CULBERT, ROBERTS P

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 11/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/967,081

Applicant(s)

LEE ET AL.

Examiner

Roberts Culbert

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7/22/02.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claim 22 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 22 recites the limitation "the fluidizing material". There is insufficient antecedent basis for this limitation in the claim. For the purpose of examination only, it will be assumed that claim 22 depends on claim 21.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by the publication to Nealey et al.

Referring to Figure 11.13, Nealey teaches a method for forming a micro-pattern on substrate by employing a mold having a predetermined pattern structure, the method comprising

steps of: preparing a mold having a predetermined pattern structure containing a recessed portion and a protruded portion; depositing a polymer material on the substrate; rendering the protruded portion the mold to be in contact the polymer material; incorporating the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force thereof, thereby removing the polymer material in contact with protruded portion the mold; and exposing a portion of the top surface of the substrate by detaching the mold to thereby form a polymer micro-pattern the substrate.

Regarding Claim 4, the mold is made from a polymer (PDMS).

Claims 1, 3, 4, 6, 12, 14, 15, 17, and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,355,198 to Kim et al.

Referring to Figure 1, Kim teaches a method for forming a micro-pattern (38) on substrate (30) by employing a mold (20) having a predetermined pattern structure, the method comprising steps of: preparing a mold having a predetermined pattern structure containing a recessed portion (24) and a protruded portion (22); depositing a polymer material (36) on the substrate; rendering the protruded portion the mold to be in contact the polymer material; incorporating the polymer material in contact with the protruded portion of the mold into an empty space of the recessed portion thereof by using capillary force thereof, thereby removing the polymer material in contact with protruded portion the mold; and exposing a portion of the top surface of the substrate by detaching the mold to thereby form a polymer micro-pattern the substrate.

Referring to Figures 1 and 10a, Kim further teaches a method of forming a micro-pattern on a substrate by employing a mold having a predetermined pattern structure, the method comprising the steps of: preparing a mold having predetermined pattern structure containing recessed portion and a protruded portion; depositing a thin film layer (124) on the substrate (126); forming a polymer material (122) on the overall surface of the thin film layer; rendering the protruded portion the mold to be in contact with the polymer material; incorporating polymer material in contact with the an empty space of the recessed portion thereof by using capillary

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force thereof to remove the polymer material in contact with the protruded portion of the mold thereby forming a polymer pattern of predetermined shape; etching the thin film layer by employing the polymer pattern as a mask thereby selectively remove a portion of the thin film layer; and removing the polymer pattern to thereby form a desired thin film micro-pattern.

** Note that Figure 1 teaches application of the capillary process to a substrate (general process) as in claim 1, but figure 10a shows the application of the process to a thin film formed on a substrate as in claim 12. For details see (Col. 25, Line 65-Col. 26 Line 31).*

Regarding Claims 4 and 15, the mold is made from a polymer (PDMS).

Regarding Claims 3 and 6, Kim teaches that after the step of depositing a thin film layer on the substrate but before the step of rendering the protruded portion the mold to be in contact the polymer material as recited in Claim 1, permeating a fluidizing material into the polymer material in order to provide fluidity to the polymer material (Col. 26, Lines 25-31). Kim further teaches that the polymer material (photoresist) is applied by spin coating (Col. 26, Lines 23-25).

Regarding Claims 14 and 17, Kim does not explicitly teach that the step of permeating a fluidizing material into the polymer material in order to provide fluidity to the polymer material after the step of forming a polymer material on the overall surface of the thin film layer but before the step of rendering the protruded portion the mold to be in contact with the polymer material, as recited in claim 12. However, it is considered an inherent teaching of the reference, as Kim teaches application of the photoresist to both a substrate (Fig 1) and a thin film (Fig 10a) in a capillary micromolding process.

Regarding Claim 19, Kim teaches that the substrate may be made of glass (Col. 25, Line 67), silicon (Col. 26, Lines 23-25) or of any other suitable substrate material (Col. 21, Lines 9-11).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been

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obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 7-11, 13, 18, and 20-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,355,198 to Kim.

Regarding Claims 2 and 13, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach performing a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold.

However, Official Notice is taken of the fact that the direct relationship between the viscosity of a polymer and the temperature of the polymer is well known in the art of molding polymers. Since capillary flow depends on the viscosity of the polymer, it would have been obvious to one of ordinary skill in the art at the time of invention to perform a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold.

On of ordinary skill in the art would have been motivated at the time of invention to perform a heat treatment to the polymer material between the steps of depositing the polymer on the substrate or thin film, and contacting the polymer with the mold since doing so would enable the polymer to be drawn into the mold by capillary action.

Regarding claims 20 and 23, Kim teaches that part of the polymer material may be incorporated into the empty space of the mold thereby rendering a remaining part of the polymer material. See Figure 8 for example. Kim teaches that the remaining part is removed (Col. 25, Lines 1-3). It would have been obvious to one of ordinary skill in the art to remove the remaining polymer material by etching since it is entirely conventional in the art to remove polymers from a substrate by etching.

Regarding Claims 7 and 10, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach depositing a thin film layer on an exposed portion of the top of the substrate and removing the polymer micro-pattern to thereby form a desired thin film micro-pattern. Official Notice is taken that it is notoriously old in the art of forming wiring

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patterns on a substrate to form a patterned photoresist on a substrate, deposit a thin film metallic layer on the exposed portions of the substrate, and remove the photoresist. Since the method of Kim forms a photoresist pattern on a substrate, it would have been obvious to one of ordinary skill in the art at the time of invention to use the photoresist patterning method of Kim to form a wiring pattern in the well-known manner.

Regarding Claims 8 and 21, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach heating the fluidizing material.

Official Notice is taken that it is well known in the art of forming photoresists to soften or swell a resist using evaporated solvent vapor. It would have been obvious to one of ordinary skill in the art at the time of invention to soften the resist using a solvent vapor formed by heating in order to provide fluidity to the resist in the conventional manner.

Regarding Claims 9 and 18, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach removal of the polymer with a solvent.

Official notice is taken of the fact that it is common to remove a photoresist with a solvent after patterning. It would have been obvious to one of ordinary skill in the art at the time of invention to remove the photoresist with a solvent in the well-known manner.

Regarding Claims 11 and 22, as applied above, Kim teaches the method of the invention substantially as claimed, but does not teach the use of a novolac resin as the polymer material or PGMEA as the fluidizing material.

Official Notice is taken that it is old in the art of forming photoresist layers to use a resist made from novolac resin and PGMEA solvent. It would have been obvious to one of ordinary skill in the art to use the conventional resist materials as the invention of Kim uses capillary molding to form resist masks and the like.

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Claims 5, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,355,198 to Kim et al in view of U.S. Patent 5,772,905 to Chou.

As applied above, Kim teaches the method of the invention substantially as claimed, but does not teach the use of an inorganic mold.

Chou teaches that an inorganic mold made of SiO_2 is suitable for molding polymers. See (Col. 4, lines 60-63). It would have been obvious to one of ordinary skill in the art at the time of invention to use an inorganic mold material as shown in Chou for molding in the method of Kim, since doing so would allow good release properties for some polymer materials as taught by Chou.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (703) 305-7965. The examiner can normally be reached on Monday-Friday (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703) 308-1633. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

R. Culbert



GREGORY MILLS
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